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Society for the Encouragement of Arts, Manufactures, and Commerce,

JOHN-STREET, ADELPHI, LONDON, W.C.

EXAMINATION PAPERS

SET AT THE

SOCIETY OF ARTS EXAMINATIONS,

HELD IN MAY, 1863.

PUBLISHED BY THE SOCIETY.

LONDON:
BELL AND DALDY, FLEET-STREET,
PUBLISHERS TO THE SOCIETY.

1863.

PRICE SIXPENCE.]

THE SOCIETY OF ARTS

Was founded in 1754, and Incorporated by Royal Charter in 1847, for "The Encouragement of the Arts, Manufactures, and Commerce of the Country, by bestowing rewards for such productions, inventions, or improvements as tend to the employment of the poor, to the increase of trade, and to the riches and honour of the kingdom; and for meritorious works in the various departments of the Fine Arts; for Discoveries, Inventions, and Improvements in Agriculture, Chemistry, Mechanics, Manufactures, and other Useful Arts; for the application of such natural and artificial products, whether of Home, Colonial, or Foreign growth and manufacture, as may appear likely to afford fresh objects of industry, and to increase the trade of the realm by extending the sphere of British Commerce; and generally to assist in the advancement, development, and practical application of every department of science in connexion with the Arts, Manuactures, and Commerce of this country."

The importation of new products from our Colonies, the reclaiming of waste lands, the improvement of Agriculture, the application of Chemistry to the Industrial Arts, and the improvement of Machinery were amongst the earliest objects to which the Society directed its attention, and its transactions show that the Premiums it has awarded, the opportunities it has afforded for discussion, and the information it has been the means of disseminating have led to many important improvements in Manufactures, and have laid open many new and valuable sources of industry and Commerce, in the United Kingdom, the Colonies and Foreign Countries.

From a very early period the Society has held Exhibitions of various kinds, which, by showing what had already been done, and the degree of perfection that had been attained, have stimulated the progress of invention and design, and directed attention to points still requiring improvement. Since its Incorporation by Royal Charter, in 1847, it has been able to carry out these objects more systematically, and by holding a series of Industrial, Mechanical, Educational, and Fine Art Exhibitions it prepared the was for the Great International Exhibition of 1851, which was originated by the Society.

It was subsequently occupied in promoting the International Exhibition of 1862, and obtained a Guarantee Fund of nearly £450,000 for that object, and a Royal Charter, incorporating Earl Granville, K.G., the Duke of Buckingham and Chandos, Sir C. Wentworth Dilke, Bart., Thomas Baring, Esq., M.P., and Thomas Fairbairn, Esq., as Her Majesty's Commissioners for carrying out the Exhibition.

In 1852 the Society founded its "Union of Institutions," and now has about three hundred Literary Scientific, and Mechanics' Institutions, and Local Educational Boards in the United Kingdom and the Colonies, in Union with it. One of the principal objects of this "Union" being the promotion of adult education, the Society has appointed a Central Board of Examiners, and for several years past has held Examinations of members of these Institutions and other persons, in all the principal branches of knowledge. To these Candidates the Society awards Prizes and Certificates. His Royal Highness the late President showed his interest in the Examinations by offering an annual Prize of Twenty-five Guineas as a special mark of distinction, and this Prize has been graciously continued by Her Majesty the Queen.

The Society publishes a Weekly Journal, entitled the "Journal of the Society of Arts," which contains Reports of the Society's Proceedings and Transactions, Reports of the Institutions in Union, and a variety of information connected with Arts, Manufactures and Commerce; the Society also enters into Correspondence and exchanges Publications with Foreign and Colonial Societies.

The Society consists of about three thousand members.

Candidates for Membership* must be proposed and recommended by three Members of the Society, according to a form, in which the name, rank, and usual place of residence of the Candidate are stated. This form is read at an Ordinary Meeting of the Society, and afterwards hung up in the Society's room until the second following meeting, when the Candidate is balloted for. The Annual Subscription of Two Guineas, payable in advance, from the quarter-day next preceding the date of election. There is no fee on admission. Any Member, by a payment of Twenty Guineas, may at any time commute his annual subscription. Foreigners and persons not resident in Great Britain may become Corresponding Members, without payment of any subscription, if proposed and elected in the usual manner. Ladies are eligible as members.

Every Member whose subscription is not in arrear is entitled—

To be present at, and take part in, the proceedings of all the Ordinary Meetings of the Society, and to introduce two visitors at such meetings.—To be present and vote at all General Meetings of the Society.—To have personal free admission to all Exhibitions held by the Society at its House in the Adelphi.—To be present at all the Society's *Conversazioni*.—To receive a copy of the Weekly Journal, or of any work in which its Transactions or Proceedings shall be published by the Society subsequent to his election.—And to the use of the Library and Reading-Room.

The Session commences in November and ends in June. At the ordinary meetings of the Society on Wednesday evenings during the Session, at eight o'clock, papers on subjects relating to inventions improvements, discoveries, and other matters connected with the Arts, Manufactures, or Commerce of the Country are read and discussed.

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* Gentlemen desirous of becoming Members should communicate with the Secretary, at the Society's House, Adelphi, London, W.C., who will also furnish information to Institutions relative to the terms and conditions of Union.

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OF THE

SOCIETY FOR THE ENCOURAGEMENT

OF

ARTS, MANUFACTURES, AND COMMERCE,

FOR THE

110TH SESSION, 1863-4.

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29. Theory of Music	John Hullah, Esq.

EXAMINATION PAPERS

SET AT THE

SOCIETY OF ARTS EXAMINATIONS HELD IN MAY, 1863.

ARITHMETIC.

THREE HOURS ALLOWED.

(No marks will be allowed for answers where the working is not shown.)

1. Find by practice the cost of 3960$\frac{11}{12}$ articles at 4s. 6$\frac{1}{2}$d. each.

2. What is the rent of 225 acres 1 rood 19 poles at 13s. 2$\frac{1}{2}$d. per rood?

3. If a railway fare for 77 miles be 22s. what will be the expense of travelling 364 miles, and what the rate per mile?

4. What part of 35s. is $\frac{5}{12}$ths of 24s.?

5. Find the value of $\frac{7}{9}$ths of $\frac{9}{14}$ths of $\frac{3}{5}$ths of £3 4s. 6d.

6. If the carriage of 17 cwt. 3 qrs. for 7$\frac{1}{2}$ miles cost 20s. 8$\frac{1}{2}$d., what weight should be carried 20 miles for 16s. 4d.? Work by decimals.

7. Find the difference between 6$\frac{1}{2}$ guineas and £3·525, and reduce it to the decimal of a crown.

8. Divide £8 3fl. 7c. among four persons: giving the first 1$\frac{1}{2}$ as much as the second; the second 1$\frac{1}{4}$ as much as as the third; and the third 1$\frac{1}{6}$ as much as the fourth.

9. A poor rate of £530 is to be levied from three parishes, the population being respectively 2,500, 3,000, 4,200. How much should each parish pay, and how much each person?

10. If I spend in 6 months as much as I earn in 4 months, how much shall I have saved at the end of a year if my earnings every 6 months are £183 17s. 6d.?

11. If sugar be sold at the rate of 5d. per lb., how much should it be bought at per cwt. to gain 25 per cent.?

12. For what sum should a ship worth £3,000 be insured at 3 per cent. in order to cover its value and the premium?

13. During the first 6 months of the year the income-tax is at the rate of 7d. in the £; but during the last 6 months it is at the rate of 5d. in the £. If a person's income, after deducting the tax, be £819, what is his gross annual income?

14. A person has £3,400 of 3 per cent. stock. He sells out at 77$\frac{1}{4}$ and buys 5 per cent. stock at 106. How is his income affected?

15. How many bricks will be required to build a wall 8 feet high, 1 foot 8 inches thick, and 5 poles in length; the dimensions of a brick being 10 inches long, 4 inches broad, and 2$\frac{1}{2}$ inches thick?

16. A watch which is 5 minutes slow at noon on Monday gains 3 minutes 20 seconds daily; what will be the true time when it points to 6 o'clock on the following Saturday evening?

17. If a person has to pay £120 in 8 equal monthly instalments, when may he equitably pay it all at once?

18. A quantity of railway stock is sold at 108 and the proceeds invested in the 3 per cents. at 91$\frac{1}{8}$; the 3 per cent. stock is then sold at 95$\frac{3}{8}$, and the original stock is repurchased at 109. The profit on the entire transaction is £109. Find the amount of railway stock.

19. The alloy in English silver is $\frac{3}{40}$ths of the whole, and in French silver $\frac{1}{10}$ of the whole, and the par of exchange between the two countries is 25 francs 22 cents., the weight of a franc being 77·16 grains. Find the price of English standard silver per ounce.

20. A. and B. can do a piece of work in 30 and 36 days respectively. They work together for 6 days, when B. leaves, but A. goes on, and after 6 days is joined by C., and then they finish the work together in 8 days. In how many days could C. alone have done the work?

BOOK-KEEPING BY DOUBLE ENTRY.

THREE HOURS ALLOWED.

1. In what consists the distinction between the double entry and the singly entry method?

2. Does double entry secure the detection of all errors to which a book-keeper is liable?

NOTE.—Reasons to be stated for the answer given to this question.

3. What are the respective uses of the Journal and Ledger?

4. Can books be kept by double entry without a Journal?

5. What should a profit and loss account and a balance sheet severally exhibit?

6. Journalise and post in due technical form and language the following supposititious transactions, and make out from the Ledger—a trial balance, a profit and loss account, and a balance sheet.

On the 1st January, 1863, John Hodge and Charles Wright found the state of their partnership affairs to be as follows:—

LIABILITIES.

Due to John Hodge, Capital	£2,000	0	0
„ Charles Wright, Capital	1,000	0	0
„ John Roe	450	0	0
The Firm's acceptance due 30th January...	820	0	0
	£4,270	0	0

ASSETS.

Cash at the Bankers	£1,250	0	0
Petty Cash in hand	5	15	0
Due from James Pott	164	5	0
„ Henry Nix	50	0	0
Bill Receivable due 15th February	400	0	0
Stock of Wine, 50 pipes	2,400	0	0
	£4,270	0	0

The Capital of the Partners bears interest at £5 per cent. per annum, and the net profits are divisible between the two partners in equal moieties.

TRANSACTIONS.

1863.				
Jan. 1.	Sold 10 pipes of wine to Henry Green	£550	0	0
„	Bought 20 pipes of Wine of Charles Brown	800	0	0
9.	Received Cash from O. G. & Co. proceeds of Bill receivable for £400 due 15th Feb. discounted with them	397	15	0
„	Discount charged by O. G. & Co.	2	5	0
12.	Paid Cash to Charles Brown	760	0	0
„	Trade discount allowed by Charles Brown	40	0	0
15.	Received Cash from James Pott on account	100	0	0
20.	Sold James Pott 2 pipes of Wine...	140	0	0
25.	Received of Henry Green his acceptance at 2 months, due 28th March	550	0	0
30.	Accepted John Roe's draft at 4 months' date	450	0	0
„	Cash paid our acceptance due this day	820	0	0
31.	Cash paid Clerk's salary 1 month...	15	0	0
„	Paid out of Petty Cash sundry trade charges	1	16	0
„	Paid out of Petty Cash on private acct. of J. Hodge	3	0	0
Feb. 1.	Advanced to Petty Cash	10	0	0
„	Cash drawn out by the partners on their respective private accounts, viz.:— John Hodge ...... 60 0 0 Charles Wright ... 50 0 0	110	0	0
2.	Sold to Richard Love 20 pipes of Wine at £50	1,000	0	0
„	Consigned to Sydney on our own account and risk, through Small & Co., 10 pipes of Wine invoiced at	600	0	0
10.	Received of Small & Co. Cash as advance on consignment to Sydney	330	0	0
15.	Bill receivable due this day returned dishonoured by acceptor, J. Nokes	400	0	0
„	Notarial charges thereon paid out of Petty Cash	0	3	6
20.	Cash received of John Nokes on account of his dishonoured acceptance	200	0	0
21.	Purchased of Henry Jones 15 pipes of Wine	750	0	0
„	Sold to H. Cox 5 pipes of Wine ...	450	0	0
„	Cash paid, Freight, Insurance, and charges on consignment to Sydney	75	0	0
23.	Received of H. Cox, Cash	200	0	0
	His acceptance due 26th May	100	0	0
24.	Received of Richard Love his acceptance due 27th of April	600	0	0
28.	Value of Stock of Wine remaining on hand at this date	1,700	0	0
„	Due to H. Good for stationery	7	10	0
„	„ H. Knott, one month's salary	15	0	0
„	„ J. Craig, two months' rent...	20	0	0
„	Credit partners' accounts with 2 months' interest on their Capital, viz.:—			
	John Hodge on £2,000	16	13	4
	Charles Wright on £1,000	8	6	8
„	Debit partners' accounts with interest on sums drawn on private Account, viz.:—			
	John Hodge 1 month on £60...	0	5	0
	C. Wright 1 month on £50...	0	4	2
„	Credit John Hodge his moiety of balance of Profit and Loss account			
„	Credit Charles Wright do. do.			

ALGEBRA.

THREE HOURS ALLOWED.

(A.)

1. State and account for the rules of signs in Algebraical Multiplication.

2. Find the value of the combined product of the factors $x+1$, x^2+1, x^4+1, x^8+1, and the product of this again by $x-1$.

3. Find the greatest common measure of 484 and 693, and then prove from your process,

1st, That the number so determined is a common measure; and

2nd, That it is contained in every other common measure of the two given numbers.

4. Reduce the quantity—

$$\left(\frac{a+b}{c+d}+\frac{a-b}{c-d}\right) \div \left(\frac{a+b}{c-d}+\frac{a-b}{c+d}\right)$$

to its simplest form.

5. If $a : b :: c : d$, prove that—

$$\frac{ma+nb}{a+qb\,p} = \frac{mc+nd}{pc+qd}$$

6. A boating crew, who can pull eight miles an hour in still water, find that it takes them two-thirds more time to go up a river than to go down it. Find the rate at which the river flows.

7. Find x, y, z from the equations—

$$\frac{x}{a}+\frac{y}{b}=1;\ \frac{x}{a}+\frac{z}{c}=1;\ \frac{y}{b}+\frac{z}{e}=1.$$

8. Solve the equation—

$$\frac{x}{x+1}+\frac{x+1}{x}=2\frac{9}{10}$$

And also the equation—

$$\sqrt{x+a}-\sqrt{x}=\sqrt{x+b}$$

B.

9. Find the third term and the sum of the geometrical series of which

$$\frac{\sqrt{2}+1}{\sqrt{2}-1} \text{ and } \frac{1}{2-\sqrt{2}} \text{ are the first two terms.}$$

10. In how many different ways can 9 people arrange themselves in a ring, with one of them in the centre?

11. Calculate the cube root of 999 to at least eight places of decimals by the Binomial theorem.

12. Solve the equations:—

$$x^2 - xy = 10$$
$$xy + 2y^2 = 33.$$

*13. If $\frac{1}{a} + \frac{1}{b} + \frac{1}{c} = \frac{1}{a+b+c}$

Prove that $\frac{1}{a^3} + \frac{1}{b^3} + \frac{1}{c^3} = \frac{1}{(a+b+c)^3}$.

GEOMETRY.

THREE HOURS ALLOWED.

1. If one side of a triangle be produced, the exterior angle is greater than either of the interior opposite angles.

2. If a straight line fall upon two parallel straight lines, it makes the alternate angles equal to one another, and the exterior angle equal to the interior and opposite upon the same side, and likewise the two interior angles upon the same side together equal to two right angles.

3. Parallelograms upon the same base, and between the same parallels, are equal to one another.

4. Describe a parallelogram equal to a given rectilineal figure, and having an angle equal to a given rectilineal angle.

5. If a straight line be divided into two equal parts, and also into two unequal parts, the rectangle contained by the unequal parts, together with the square of the line between the points of section, is equal to the square of half the line.

6. One circle cannot touch or cut another in more than two points.

7. In equal circles the angles which stand upon equal circumferences are equal to one another, whether they be at the centres or the circumferences.

8. Describe an isosceles triangle having each of the angles at the base double of the third angle.

9. Similar triangles are to one another in the duplicate ratio of their homologous sides.

10. In right-angle triangles the rectilineal figure described upon the side opposite the right angle is equal to the similar and similarly described figures upon the sides containing the right angle. Why are the words "Similarly described" necessary?

11. If two straight lines be parallel, and one of them is at right angles to a plane, the other shall also be at right angles to the same plane.

12. Every solid angle is contained by plane angles, which together are less than four right angles.

PROBLEMS.

1. If, from a point without a parallelogram, lines be drawn to the extremities of two adjacent sides, and of the diagonal which they include; then of the triangles so formed, that which has the diagonal for its base is equal to the sum of the other two.

2. Trisect a parallelogram by lines drawn from a given point in one of its sides.

3. Given the base, the altitude, and the difference of the two sides of a triangle: construct it.

4. In any triangle the squares of two sides are together double of the two squares of half the base, and of the straight line joining its bisection with the opposite angle.

5. Given two circles, it is required to find a point from which tangents may be drawn to each, equal to two given straight lines.

6. A chord of a circle is drawn cutting a diameter at an angle which is equal to half a right angle, the sum of the squares of the two portions of the chord is equal to twice the square of the radius.

7. If a circle roll within another of twice its size, any point in its circumference will trace out a diameter of the larger circle.

8. Show that a circle may be inscribed in any quadrilateral figure if the sums of its opposite sides are equal.

9. Describe a circle which shall pass through a given point, and touch two given equal circles.

10. The rectangle contained by the sides of any triangle is to the rectangle of the radii of the inscribed and circumscribed circles as twice the perimeter is to the base.

MENSURATION.

THREE HOURS ALLOWED.

1. Multiply 5 feet 7 inches by 3 feet 9 inches by the method of cross multiplication; explaining by a diagram each step in the process.

2. The length of a side of a triangle is 9 feet 9 inches, and its distance from the opposite angle is 6 feet 5 inches, the length of another side is 8 feet 3 inches; find its distance from the opposite angle, employing the method of duodecimals.

3. The diagonal of a sheet of paper is twice as long as one of the sides, which is 10·5 inches; find the length of the other side.

4. Lay down the figure of the field and find its area from the following notes:—

	AC.	
	1,300	
	890	680 to D.
to B 220	215	
	⊙A	

Find what would have been the notes of this field if B D had been taken as the main line.

5. Find the area of a four-sided figure of which two opposite sides are parallel.

The roof of a room 20 feet square rises in four compartments to the height of 12 feet, and terminates in a skylight 10 feet square; find the cost of slating it at £2 17s. per square.

6. What would be the cost of the covering and guttering of the roof of a church with lead at £1 19s. per cwt., the length of the roof being 82 feet 9 inches, and its girt 65 feet 3 inches, and the breadth of the guttering 1 foot 9 inches, the thickness of the lead $\frac{1}{5}$th of an inch; and the weight of a square foot of lead an inch thick being 59 lbs.?

7. Supposing a French metre, which is one ten millionth part of the fourth of a meridian on the earth's surface, to be 39·37 inches, find the number of miles in the earth's diameter.

8. Find the area of a segment of a circle, having given (1) the chord and the diameter, (2) the height and the diameter, (3) the height and the chord.

9. A cube is divided into two parts by a plane which passes through one angle and the diagonal of one of the opposite sides; compare the volumes of the two parts into which the cube is divided.

10. If a sphere and the circumscribing cylinder be cut by two planes at right angles to the axis of the cylinder, the surfaces of the sphere and cylinder between these planes will be equal.

11. A gallon contains 277·274 cubic inches; what would be the diameter of a bushel measure supposing its depth to be equal to its diameter?

12. How much of the earth's surface is visible from a balloon five miles high? Approximately.

13. The height of a cone is 10 feet 6 inches, its slant side 12 feet 9 inches; find its volume.

14. Find the content of a haystack with a circular base.

TRIGONOMETRY.

THREE HOURS ALLOWED.

1. If A, B, C, be a triangle, and $\text{Sin.}\,^2A = \text{Sin.}\,^2B$ $\text{Sin}\,^2C$, show that it is right-angled.

2. Prove the formulas:—

(1.) $\text{Tan. A} + \text{Sec. A} = \tan\left(\frac{\text{A}}{2} + \frac{\pi}{4}\right)$

(2.) $\frac{\text{Sin. A} + 2\ \text{Sin. 3 A} + \text{Sin. 5 A}}{\text{Sin. 3 A} + 2\ \text{Sin. 5 A} + \text{Sin. 7 A}} = \frac{\text{Sin 3 A}}{\text{Sin 5 A}}$

3. Find the sine 18°, tan. 37° 30′, and sec. 54°.

4. If A, B, C, be a right-angled triangle, C being the right angle and C D, C E be drawn making angles α & β, with the hypothenuse, the area of C D E,

$$= \frac{a^2 b^2}{2 c^2} (\text{Cot. } \alpha - \text{Cot. } \beta.)$$

5. Show that—

$\text{Sin. (A + B) Sin. (A − B)} = \text{(Sin. A + Sin. B) (Sin. A − Sin. B)}$

$\text{Cos. (A + B) Cos. (A − B)} = \text{(Cos. A + Sin. B) (Cos. A − Sin. B.)}$

6. A vessel appears due north of an observer, and four miles distant; half an hour afterwards it is due east, and at the end of another half hour it disappears in the S.E. Find its course and nearest distance from the observer.

7. In a triangle prove $c^2 = a^2 + b^2 - 2\,a\,b\ \text{Cos. C}$. Then show how this formula may be adapted to logarithmic computation.

8. Solve the triangle when a, A, and $b + c$ are known.

9. Expand Sin. x in terms of the powers of x.

If $x = \text{Cosec } x$, show that $x = \frac{557}{550}$ nearly.

10. A, B, C, are three points in a straight line, in the same vertical plane with an object P; $\text{AB} = a$, $\text{BC} = b$; the angle of elevation of P from B is twice as great as from A; and from C three times as great. Find the height of P.

11. In a spherical triangle find Cos. α in terms of the cosines and sines of the angles.

12. The angles at the base of an isosceles spherical triangle are equal.

13. In a right-angled spherical triangle, if D be the length of the arc CD, drawn at right angles to the hypothenuse AB, show that—

$$\text{Cot. D} = \sqrt{\text{Cot.}^2 a + \text{Cot.}^2 b}.$$

14. Prove the formulas—

$\text{Cos. } \tfrac{1}{2}(\text{A} + \text{B}) \text{ Cos. } \tfrac{1}{2} c = \text{Cos. } \tfrac{1}{2}(a + b) \text{ Sin. } \tfrac{1}{2} \text{C}$

$\text{Cos. } \tfrac{1}{2}(\text{A} - \text{B}) \text{ Sin. } \tfrac{1}{2} c = \text{Sin. } \tfrac{1}{2}(a + b) \text{ Sin. } \tfrac{1}{2} \text{C}$

CONIC SECTIONS.

THREE HOURS ALLOWED.

Section I.—Geometrical Conics.

1. Define the conic sections (1) as plane sections of a cone, (2) in reference to a focus and directrix. From the latter definition deduce methods for describing a parabola by continual motion and by points.

2. Prove that the tangent at any point of a parabola bisects the angle between the focal distance and the perpendicular on the directrix. What form does this theorem take in the ellipse and hyperbola?

3. If MP is an ordinate to a parabola at the point P, prove that $\text{PM}^2 = 4\ \text{AS. AM}$. What modifications are required in this theorem when the co-ordinate axes are oblique?

4. If two chords of a parabola intersect each other, the rectangles contained by their segments are in the ratio of the parameters of the diameters which bisect the chords.

5. If S and H are the foci of an ellipse, and P is any point on the curve, prove that $\text{SP} + \text{PH} = 2\text{CA}$; and hence prove that the tangent at P is equally inclined to SP and HP.

6. If the normal to an ellipse at P meets the major axis in G, show that SG : SP :: CS : CA.

7. Define conjugate diameters of an ellipse; and show that the area of a parallelogram circumscribing an ellipse and having its sides parallel to a pair of conjugate diameters is constant.

8. A part of a branch of the hyperbola is drawn; how do you ascertain it to be a part of a hyperbola? Find its centre, axis, foci, directrices, and asymptotes.

9. Prove that the area of the triangle contained between the asymptotes of a hyperbola and the tangent at any point is constant.

10. A series of parallel chords is drawn in a circle; the diameter is drawn at right angles to all, at the extremities of which tangents are drawn to the circle. The circle is projected into an ellipse; what are the projective theorems of the lines?

Section II.—Analytical Conics.

11. Construct formulæ for passing from one rectangular system of co-ordinates to another rectangular system. The equation to a straight line being $y = b$, what is the equation when the axes are turned through 45°?

12. Find the length of the perpendicular from (2,7) on $ax + by + c = 0$.

13. Prove that all angles in the same segment of a circle are equal to another, and that the angle *of* a segment greater than a semi-circle is greater than a right angle.

14. If the base of a triangle is given, and one base angle is twice the other, prove that the locus of the vertex is a hyperbola, of which the angle between the asymptotes is 120°, and the centre is at a tri-secting point of the base.

15. Prove that the point of intersection of a tangent to a parabola with the perpendicular on it from the focus is in the tangent of the parabola at its vertex.

16. Prove analytically the theorems contained in questions 5, 6, 7, 9, of the preceding section.

17. Show that the equation of the second degree may always be reduced to $y^2 = 4\,MX + NX^2$. When does the equation represent (1) an ellipse, (2) a parabola, (3) a hyperbola?

NAVIGATION AND NAUTICAL ASTRONOMY.

THREE HOURS ALLOWED.

Only one question to be answered in each section.

I.

1. June 17, 1863, the observed meridian altitude of ∝ Serpentis was 29° 50′ 40″ (zenith south of the star), the index error of the sextant was *plus* 4′ 20″, and the height of the eye above the sea 24 feet. Required the latitude.

2. On February 4, 1863, about 4h. 50m., A.M., mean time, in latitude 51° 20′ S., longitude 124° 10′ W., the sun bore by compass N. 84° 56′ E., and the observed altitude of the sun's lower limb at the same time was 6° 30′ 10″, the index error *plus* 1′ 15″, and the height of the eye above the sea 15 feet. Required the variation of the compass.

II.

1. September 19, 1863, in latitude by account 58° 10′ N., longitude 56° E., the following double altitude of the sun was observed:—

Mean time nearly.	Chronometer.	Observed altitude lower limb.
7h. 30m. A.M.	5h. 15m. 22s.	21° 20′ 30″
10h. 15m. ,,	8h. 0m. 31s.	37° 0′ 20″

The run of the ship in the interval was N.N.E. ½ E. 20 miles; the index error was *plus* 3′ 20″, and the height of the eye 30 feet. Required the true latitude of the place of observation.

2. August 23rd, 1863, at 9h. 40m. P.M. (mean time nearly), in latitude 30° 10′ N, and longitude by account 22° 50′ W., when a chronometer showed 11h. 4m. 20s., the observed altitude of ∝ Pegasi east of meridian was 43° 32′ 20″, the index error was *plus* 2′ 0″, and the height of the eye above the sea was 20 feet. Required the

longitude. On August 1, at noon, the chronometer was slow on Greenwich mean time 5m. 40s., and its daily rate was 3·7s. losing.

III.

1. Prove that *meridian distance* is equal to the *difference of longitude* multiplied into the *cosine of the latitude.*

2. Prove that $\textit{tan course} = \dfrac{\textit{diff. longitude.}}{\textit{mer. diff. latitude.}}$

3. Prove that meridional parts of the sphere = log. (cos. half latitude) × M.

IV.

1. Required the compass course and distance from A to B:—

$$\left.\begin{array}{l}\text{Lat. A } 49^\circ\ 30'\\ \text{,, \ B } 49^\circ\ 30'\end{array}\right\}\text{S.}\quad\begin{array}{l}\text{Variation } 2\tfrac{1}{2}\text{ W. lon. A } 2^\circ\ 20'\text{ E.}\\ \text{Deviation } 8^\circ\ 50'\text{ W. ,, \ B } 3^\circ\ 40'\text{ W.}\end{array}$$

2. A ship sails from latitude 67° 10′ N., and longitude 10° 15′ W., S. by W. 35, N.N.W. 22, E.N.E. 17, S.S.E. 14 miles. Required the latitude and longitude arrived at.

3. A ship steams 11 knots an hour, and her apparent course is W. by S., what is her true course and distance in 4¾ hours supposing a current drifting N. ¾ E. 2½ knots an hour?

V.

1. Explain what is meant by the Polar Triangle, and demonstrate its chief properties.

2. In a right-angled spherical triangle, given the hypothenuse and one of the adjacent angles, find the other two sides.

3. State and prove Napier's Analogies.

VI.

1. What is meant by *mean time* and *sidereal time?* and show how one may be converted into the other. Ex. What is the sidereal time at a place whose longitude is 125° W. of Greenwich, on June 11, 1862, at 3 h. 40 m. local mean time.

2. The following errors of a chronometer, from mean solar time at noon, at each place were determined viz.:—

Port Royal, Feb. 9th, + 5h. 13m. 5·0s.
Alta Vela, Feb. 20th, + 4h. 52m. 34·5s.
Port Royal, Feb. 28th, + 5h. 13m. 44·3s.

Required the longitude of Alta Vela, the longitude of Port Royal being 78° 50′ W., the rate of chronometer being supposed to be uniform; also *state* the principal methods of finding the longitude by observations.

VII.

1. Show how to find the hour angle or meridian distance of a star from the observed altitude. How is it determined whether it is east or west of the meridian?

2. Explain the method of finding the latitude by meridian altitudes.

3. Investigate a method of clearing a lunar distance.

Ex. Apparent altitude sun's centre 23° 5′.
Apparent altitude moon's centre 49° 16′.
Apparent distance of the centres 75° 42′ 25″.
Horizontal parallax 54′ 47″.
Find the true distance.

VIII.

1. Describe the sextant, and explain the principle on which it is graduated.

2. What are the principal adjustments of the sextant? and describe the observations for the determination of the index error.

PRINCIPLES OF MECHANICS.

THREE HOURS ALLOWED.

1. What are the different kinds of force which enter into statical investigations?

2. Investigate the two conditions fulfilled by any number of forces, acting on one point in a plane, which are in equilibrium.

Two rafters of a roof (whose weights are not to be taken into account) are inclined to their tie-beam at an angle of 60°; at their common top is suspended a weight of 10 cwt.; find the strain of the tie-beam.

3. Prove the ratio between the power and weight of a smooth heavy body at rest on an inclined plane.

Supposing the plane to be rough, show how the ratio is altered.

What is meant by "the limiting angle of resistance" in this case?

A mass of iron weighing 500 lbs. rests on a perfectly smooth plane inclined at an angle of 30° to the horizon; what strain must a bar in the plane sustain that prevents it sliding down?

If the plane be of oak (for which the limiting angle of resistance is 30° nearly), what force parallel to the plane will be required just to drag it up?

4. Describe the different systems of pulleys, and state the excellencies and defects of each.

In a system of pulleys, in which each pulley hangs by a separate string, there are three pulleys of equal weights; the weight attached to the lowest is 96 lbs., and the power is 33 lbs.; find the weight of each pulley.

5. Describe Attwood's Machine, and show how the three laws of motion are illustrated by different experiments on the machine.

Two weights of 63 and 64 ounces respectively, are hung over a nearly frictionless pulley by means of a fine silk string; determine the spaces described by these weights at the end of 1, 2, 3, 4 seconds.

6. Explain the terms "centre of oscillation," "centre of percussion," employed in dynamics.

A mass of oak swung from a horizontal axis makes 43 oscillations in a minute; where is its centre of percussion?

7. What is meant by "the moment of inertia," and "radius of gyration" of a body about an axis?

Find them about the axis on which a grindstone revolves, which is 4 feet in diameter and 8 inches thick.

8. State and prove the two conditions fulfilled by a floating body. What third condition is necessary that its flotation may be stable?

A cube is placed in a liquid four times its density; show that there are three positions in which it will float with only one edge in water.

9. Describe the action of a common pump; point out the practical defects, and the limits to its working.

Why does the labour of working it increase at every stroke until it discharges water?

What other pumps may be used where the common pump fails?

10. Describe the syphon, and explain by it the action of intermittent springs.

11. Give the chief features in the construction of an aneroid barometer.

12. Describe a diving bell.

A diving bell, of the form of a cube 10 feet each way, is sunk to a depth of 400 feet; how far will the water enter at first?

13. Investigate the strain at each point of a flexible chain hung from two horizontal points.

How will your investigations affect the construction of suspension bridges?

14. Show that the most general motion of any free rigid body may be represented by two co-existing motions.

PRACTICAL MECHANICS.

THREE HOURS ALLOWED.

1. Describe the single-acting steam-engine invented by Watt to remedy the defects of Newcomen's atmospheric engine.

2. Sketch in section the cylinder, piston, and steam-valve of a double-acting steam-engine, and explain the manner in which the admission and exit of the steam is regulated?

3. What is meant by working an engine expansively, and how is it accomplished? If the steam be cut off when the piston has completed one-fourth of its stroke, show that the work done in the cylinder is more than half that which would result from maintaining the full pressure of the steam until the end of the stroke.

4. Explain the "parallel motion" of a beam-engine.

5. You are required to give some account of the construction of a locomotive engine and boiler, and to point out the peculiar merits of Stephenson's invention.

6. Explain the following mechanical contrivances:—(1) A ratchet-wheel; (2) a mangle-wheel; (3) an escapement; (4) a fusee; (5) bell-crank levers; (6) the Geneva stop.

7. What is the usual arrangement of the train of wheels in an eight-day clock? How is the motion of the last wheel controlled?

8. Mention some contrivances which exhibit motion of a compound or aggregate character. Explain the sun and planet wheels invented by Watt to impart motion to the fly-wheel of a beam-engine, and show that the fly-wheel makes two revolutions for each double stroke of the piston.

9. You are required to explain, in general terms, the construction of a machine for planing iron, and to describe the mechanism employed for obtaining the necessary movements.

10. Describe some form of self-acting drilling machine.

ELECTRICITY, MAGNETISM, AND HEAT.

THREE HOURS ALLOWED.

1. Illustrate and explain the terms, magnetic attraction, repulsion, and induction.

2. What is meant by the terms *Isoclinal lines*. Explain the mode of distribution of terrestrial magnetism.

3. Name the most strongly diamagnetic bodies, and state the nature of their properties.

4. State the leading properties of electricity as excited by friction.

5. What is an electrophorus? Explain its action.

6. Give some account of the means employed to protect ships from lightning, and of the conditions essential to efficiency.

7. What is meant by "quantity" and "intensity" in a voltaic battery, and for what purposes are those qualities respectively most available?

8. Explain the structure and action of De Luc's or Zamboni's pile.

9. By what means may the magnetic properties of a voltaic current be demonstrated? State some practical applications.

10. By what means can a thermo-electric be readily demonstrated, and what are its peculiar features?

11. Describe the structure and action of the electric organs of some fish.

12. Explain the relation between muscular action and a voltaic current.

13. Explain the construction of some one working submarine cable.

14. What is the object of a *relay?* Explain the construction of some efficient one, and, if you can, of some one that is employed in practice.

15. Explain the difference between *conduction* and *convection* of heat. Give some practical illustration of convection.

16. State the principal means employed in measuring heat, and the chief sources of error.

17. If a boiler, heated up to 200° C., bursts, would the whole of its contents, or what proportion of them, fly off in steam?

18. Illustrate the undulatory theory of heat by showing experimentally the application of the laws of reflection.

19. Explain the "Dew point," and the best instrumental means of observing it.

20. Explain the difference in the sensible warmth or coldness of different bodies at the same temperature. Apply this principle to clothing.

ASTRONOMY.

THREE HOURS ALLOWED.

1. Define the axis of the earth and that of the heavens, also the poles of the earth and those of the heavens.

2. Define the equator of the earth and that of the heavens, and state why the latter is called the equinoctial.

3. What is the ecliptic? is it parallel to or inclined to the equinoctial?

4. What is the breadth of the zodiac and where is it situated?

5. What are the colures, and where are they situated?

6. Define longitude on the earth and in the heavens.

7. Define right ascension and declination of a heavenly body.

8. Define latitude on the earth and in the heavens, and state the latitude of the sun.

9. What is the orbit of a planet, and define the plane in which a planet moves.

10. What is the inclination of the orbit of a planet, and define the nodes of a planet.

11. What points in a planet's orbit are called Apogee and Perigee, and define the line of the apsides.

12. What is the difference between an apparent solar day and a mean solar day?

13. Define a Sidereal day and a Sidereal year.

14. What is a solar or tropical year?

15. How can the mean distance of the sun from the earth be determined?

16. The parallax of the sun has been considered as 8"·58; from observations recently made, it seems to be more nearly 8"·9. If the latter be correct, what change will have to be made in the sun's mean distance from the earth?

17. State in general terms the method of determining right ascension and declination of a heavenly body.

18. Explain the principles of a lunar eclipse, and state why we have not a lunar eclipse at every full moon.

19. What are the errors of a Transit Instrument? and deduce their numerical corrections.

20. Explain the aberration of light, and state its effect on a star's position.

21. Given, the apparent zenith distance of Mars' south limb:—

As observed at Greenwich, 71° 33' 21"·5.
The correction for refraction, 2' 54"·5.
The correction for parallax, 10·"5.
The latitude of Greenwich, 51° 28' 39"·0.
And the semi-diameter of the planet, 5"·7.
What is the North Polar distance of the planet?

CHEMISTRY.

THREE HOURS ALLOWED.

1. What weight of air is required for the complete combustion of a pound of carbon? What weight is required for the combustion of a pound of hydrogen?

2. What volume of hydrogen is required to form a cubic foot of each of the following gases or vapours, viz., hydrochloric acid, water, and ammonia?

3. Describe the preparation and chief properties of sulphuretted hydrogen. Explain, by an equation, the reaction by which the gas is liberated in the action of hydrochloric acid on sulphide of antimony.

4. How is iodine prepared? How separated from chlorine? How estimated quantitatively?

5. Describe the action of nitric acid at various degrees of concentration on the following substances, viz., carbonate of baryta, metallic tin, and metallic zinc.

6. Describe the structure and composition of a flame of coal gas. By what contrivances can marsh gas be made to burn with emission of bright light, like that of olefiant gas?

Second Division.

1. What is the action of hydrochloric acid on the following metals, viz., antimony, tin, bismuth, lead? How does sulphuric acid act upon these metals?

2. Describe the composition and properties of some of the most important alloys of copper.

3. What would you do with a black precipitate, formed by sulphuretted hydrogen in a strongly acid solution, in order to ascertain its composition?

4. How is metallic aluminium prepared? Describe its characters, also those of its salts.

5. How is lime distinguished from baryta? How are the two bodies separated quantitatively?

6. Describe the manufacture of soda. What are its chief impurities, and how are they detected?

Third Division.

1. What are the chief products besides alcohol which are formed in vinous fermentation?

2. How is glycerine best obtained in a state of purity? Give its formula and its chief reactions.

3. How is gun cotton prepared for photographic use? What differences of its properties can be produced by modifications in the concentration of the acid?

4. How is benzole obtained from benzoic acid; how from coal tar? What is its boiling point? What is the action of nitric acid upon it?

5. How is lactic acid prepared from sugar? Give its formula and chief reactions.

6. Describe and explain Liebig's combustion apparatus. How do you calculate the formula of an organic body from the results of a combustion?

ANIMAL PHYSIOLOGY (IN RELATION TO HEALTH).

THREE HOURS ALLOWED.

1. Describe the structure, general and microscopic, of a living human canine tooth. Explain how a tooth is formed, how it grows and lives, what are the uses of the teeth, and how their decay and loss may affect the animal economy.

2. State in general terms the chemical composition of milk, beer, wine, alcohol, coffee, and tea; and also, so far as is known, their respective actions as articles of food.

3. Describe the source and chemical nature of the gastric juice. When is it formed; and what circumstances may favour, and what impair, its healthy formation and action?

4. Mention the ingredients and composition of ordinarily pure atmospheric air, and the changes it undergoes in respiration. Afterwards give what information you can as to the particular change which makes air so respired less and less fit for further breathing—the rate at which it becomes deteriorated in one and successive respirations, and the point at which it becomes incapable of supporting the life of a warm-blooded creature.

5. Give some examples of the immediate and remote consequences to the human economy of breathing good or bad air.

6. Explain generally the function of excretion; the fundamental characters of the organs by which it is performed, the nature of the process itself, and its purpose in living animals or plants.

Illustrate the subject anatomically and physiologically, by special reference to the excretory apparatus and excretions of the skin.

BOTANY.

THREE HOURS ALLOWED.

The Candidate is expected to answer correctly six questions in Section I. and eight questions in Section II.; Nos. 11 *and* 12 *of the latter each standing for one answer.*

Section I.—(Vegetable Physiology.)

1. Describe the mode of origin and principal modifications of the *duct.*

2. Describe, in general terms, in order, from the centre to the circumference, the *Systems* and *Tissues* of which they are composed, laid bare in a transverse section of the stem of an *Oak.*

3. Out of what vital processes does the *liberation* of carbonic acid gas arise?

4. Name three plants affording *milk-sap* for economic use. In what tissue and in which part of the plant does it usually occur?

5. What is the function of the *Stigma?*

6. What is *Dry-rot?* How does it affect timber What circumstances *counteract* and what *favour* it?

7. Upon what does the success of a *graft* depend?

8. What is the function of the *root?*

Section II.—(Practical Botany.)

1. Name the two principal types of *aestivation.*

2. State the difference between *Spike, Spadix,* and *Catkin.*

3. What is meant by *Cohesion* and *Adhesion?*

4. What is the *Connective?*

5. Distinguish *Dipsaceæ* from *Compositæ.*

6. Describe the *fruit* of *Umbelliferæ,* and its principal modifications.

7. Give the diagnostic characters of the natural order *Cruciferæ.*

8. Describe the structure of the *Ovary,* and of the *fruit* of *Quercus* and *Corylus.*

9. How does *Rye* differ from *Barley?*

10. Give the natural orders of the plants marked A, B, C, D, with reasons for your opinion.

11 and 12. Describe the two plants now placed before you strictly according to the form given in "Descriptive Botany," chap. vii.*

AGRICULTURE.

THREE HOURS ALLOWED.

1. What is the arable farmer likely to be engaged in during the month of October in the Southern counties.

2. What advantages may be expected from steam cultivation as compared with cultivation by horse labour.

3. Describe the home manufacture of "Superphosphate."

4. What, and how much per acre, are the dressings of the different manures usually given to ordinary arable crops under liberal management.

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* Any two plants, in flower, may be taken by the Local Examiner, he reporting their names to the Society of Arts when he returns the Candidates' papers.

5. To what may the fertilising effects of irrigation be attributed.

6. What explanations have been given of the so-called clover sickness.

7. What crops and what extent of each would you grow on 600 acres of stiff clay land; and in what order would they follow each other.

8. Describe the cultivation of (a) Barley and of (b) *Trifolium incarnatum*—naming the soil preferred by each, its proper place in the rotation, the previous cultivation needed, and probable produce under favourable circumstances.

9. What is the annual food of a well-kept farm horse, month by month?—estimate its cost.

10. What extent of the several kinds of cropping must be grown upon a light land farm, and what quantity, and kinds, and cost of other food must be provided, for a flock of 100 Hampshire down ewes bought in August, kept throughout the year for early lamb, and fattened with their produce, to be all sold within 12 months.

11. What is the probable winter's food of a bullock coming three years old, and then fattening to 8 cwt. during the last four months of the process; estimate its cost per week.

12. What period do the mare, the cow, the ewe, the sow, respectively go with young.

MINING AND METALLURGY.

THREE HOURS ALLOWED.

Six Questions to be answered.

1. Describe the Castillian Furnace employed for the treatment of lead ores of low produce.

2. Which are the principal ores of zinc, and on what principle is their metallurgic treatment conducted?

3. In what way is coke manufactured from small coal?

4. How is an assay of galena for lead and silver most advantageously performed?

5. What do you understand by the terms, "Stope," "Winze," and "Level," as applied to metallic mining?

6. Give the process of smelting iron ores by the hot blast.

7. Describe in outline the process employed in this country for the conversion of cast iron into malleable iron.

8. For what purpose is antimony chiefly used, and how is this metal obtained from its ores?

9. Describe the Davy Lamp.

10. What is the difference between working coal by "long wall" and "pillar and stall?"

11. Give the method of determining the duty of an ordinary Cornish pumping engine.

12. What will be the mean produce of three piles of copper ore:—The first being 40 tons, assaying 8 per cent.; the second, 60 tons, assaying 7¾ per cent.; and the third, 31½ tons, assaying 6⅜ per cent.?

POLITICAL AND SOCIAL ECONOMY.

THREE HOURS ALLOWED.

It is desirable that the first series of questions be answered. The second series are optional.)

I.

1. State Professor Jones's threefold division of labourers, the different funds from which each division is paid, and the different proportions in which they exist in different parts of the world.

2. What is the effect of absenteeism upon wages?

3. What were the economical effects of emancipation on the British colonies—more especially on British Guiana?

4. Give a sketch of the history of the Excise, and explain the principles upon which it rests. State its most important branches, and their present productiveness? With what taxes is it now classed, and under what head of revenue?

II.

1. Explain the origin of tenant-right in Ireland, and the questions involved in the present assertion of that right.

2. State the principles which regulate the course of exchange between two countries, and illustrate them by the present state of the exchanges with America.

3. Give the substance of Mr. Mill's account of peasant proprietors.

DOMESTIC ECONOMY.

THREE HOURS ALLOWED.

1. Explain what you understand by domestic economy, and enumerate under different heads what you think it embraces.

2. What considerations should influence one in choosing a residence, and what are the evils which arise from sitting and sleeping in ill-ventilated apartments?

3. How would you regulate the diet and clothing of a family, having reference to their occupation in life, health, and economy?

4. Enumerate some of the simplest household arrangements most important for the preservation of health.

5. What are the comparative prices of tea, coffee, and cocoa, and which is the most nutritious and economical as an article of daily consumption?

6. Give directions for making cheap and nutritious soups.

7. What qualifications should characterise a good servant as cook or housemaid, and what qualifications in a mistress would best tend to develop them?

8. Give directions for the management of a dairy, a poultry-yard, and a laundry.

9. What are the leading principles of good management in the mother of a family in the labouring classes?

10. Enumerate the advantages of a garden to a labouring man with a family, and the useful things which may be taught to his children by the skilful cultivation of it.

11. What are the properties of the potatoe which give it the advantage over other vegetables, and what garden vegetables do you consider most nutritious?

12. Explain what you consider to be the best way of laying up small weekly savings to the greatest advantage, so as to be useful when wanted, and state your reasons.

13. How is the health, happiness, and morality of the working man and his family affected by the circumstance of his having a commodious and fitting cottage to live in?

14. What do you consider the most fitting education for the children of the labouring classes up to 12 or 13 years of age? and how are their prospects in life affected by it?

GEOGRAPHY.

THREE HOURS ALLOWED.

1. Draw from memory a rough map of some part of the British islands—either a county, a river-basin, or any tract inclusive of one of the great seats of manufacturing industry. Mark on it the places of the principal towns.

2. Give the names of the principal towns that are within the cotton-manufacturing district of England, and specify with precision the situation of each.

3. Name any six of the English counties that are chiefly distinguished as agricultural counties; also any six that are principally manufacturing. Mention one or more towns in each.

4. Enumerate the principal coal-fields of Great Britain and Ireland, with some of the towns that fall within their limits?

5. Name the rivers of Scotland, in order of geographical succession round the coast; also six of the principal lakes.

6. Name the river on which each of the following is situated:—Leeds, York, Shrewsbury, Ely, Hereford, Winchester, Glasgow, Perth, Carlisle, Maidstone, Cork, and Waterford. Also the county to which each belongs.

7. Give the names of the Australian colonies, with their capitals; state also, in reference to each, the distinguishing conditions of its produce and industry.

8. Name the British colonies in North America, with the capital of each. State in what their exports chiefly consist.

9. Draw a rough map of France, showing the river-basins, mountain-ranges, and chief towns.

10. Write a short account of the geography of the modern kingdom of Greece.

11. Describe any one of the under-named rivers, stating (in round numbers) its length in miles, general character of basin, names of principal affluents, and nature of outlet.

(*a*) The Volga.
(*b*) The Mississippi.
(*c*) The Ganges.

12. Say briefly what you know concerning the trade-winds and the monsoons, distinguishing particularly the regions in which they prevail.

13. Account for the fact that the direction of Isothermal Lines often deviates widely from that of parallels of latitude. In which of the zones is the deviation greatest?

14. Give some instances of the altered distribution of vegetable and animal life due to the agency of man, in reference particularly to the plants and animals originally confined to either hemisphere, and now distributed over both the old and the new worlds.

15. State some of the distinguishing conditions (as to outward appearance, habits, &c.) of the following families of mankind:—The Negro, the Hottentot, the Malay, the native Australian, and the New Zealander.

ENGLISH HISTORY.

THREE HOURS ALLOWED.

1. Give, with dates, a short life of King Alfred?

2. What were the principal changes introduced into England by the Norman Conquest?

3. State the chief facts in the reigns of John, Henry III., and Edward I., that bear upon the growth of the English Parliament.

4. Explain the respective pretensions of Balliol and Bruce to the crown of Scotland, and state what claim was advanced by Edward I. when he was made umpire?

5. What were the chief causes of the wars of the Roses?

6. Give, with dates, a short outline of Queen Elizabeth's reign.

7. What were the grievances for which the Commons demanded redress in the Petition of Right?

8. Give a short account of the Habeas Corpus Act, and say whether it is to be regarded as a confirmation of old rights, or as a grant of new privileges.

9. On what grounds did our North American colonies rebel against the British Crown, and what were the first incidents of the rebellion?

10. Give a short account of the campaign of Lord Cornwallis in 1781.

11. Give the names of the states that finally established their independence, and notice briefly by whom and when they were settled.

12. Write a short life of the Black Prince, of Sir Walter Raleigh, or of Lord Nelson.

13. Describe the battle of Poictiers, of Towton, or of Edgehill.

14. Enumerate the chief English possessions in 1863.

ENGLISH LITERATURE.

THREE HOURS ALLOWED FOR THE TWO AUTHORS SELECTED BY THE CANDIDATE.

CHAUCER.

The Knight's Tale.

I.

(a) Wost though nat well the old clerkes sawe,
That who schal geve a lover eny lawe,
Love is a grettere lawe, by my pan,
Then may be geve to eny earthly man?
Therefore posityf lawe, and such decre,
Is broke away for love in ech degree.

(b) The busy larke, messager of daye,
Salueth in hire song the morwe gray;
And fyry Phebus ryseth up so bright,
That all the orient laugheth of the light,
And with his stremes dryeth in the greves
The silver dropes, hongying on the leeves.

(c) Ther saugh I furst the derk ymaginyng
Of felony, and al the compassyng;
The cruel ire, as reed as eny gleede;
The pikepurs, and eek the pale drede;
The smyler with the knyf under his cloke;
The schipne brennyng with the blake smoke;
The tresoun of the murtheryng in the bed;
The open werres, with woundes al bi-bled;
Contek with bloody knyf, and sharp manace.
Al ful of chirkyng was that sorry place.

(d) The firste moevere of the cause above,
Whan he firste made the fayre cheyne of love,
Gret was theffect, and heigh was his entente;
Wel wist he why, and what thereof he mente;
For with that fayre cheyne of love he bond
The fyr, the water, the eyr, and eek the lond
In certeyn boundes, that they may not flee—

1. State the connexion in which each of the above passages occurs.

2. Turn the first two of them into modern English.

3. Explain the allusions, obsolete words, and peculiar constructions.

4. What words must be pronounced differently from modern usage in order to bring the verse within the laws of metre?

II.

1. From what sources did Chaucer take the story of Palamon and Arcite?

2. Sketch the story very briefly.

3. Give some account of Chaucer's visit to Italy.

4. Name Chaucer's principal works, in prose and verse.

5. Who were the most distinguished of Chaucer's contemporaries?

Shakspere.

Macbeth; Julius Cæsar; As You Like It.

I.

1. [1] He that's coming
Must be provided for: and you shall put
This night's great business into my despatch;
Which shall to all our nights and days to come
Give solely sovereign sway and masterdom.

[2] Then is there mirth in Heaven
When earthly things made even
Atone together.

[3] This tyrant, whose sole name blisters our tongues,
Was once thought honest; you have loved him well;
He hath not touched you yet. I am young, but something
You may deserve of him through me.

[4] A good and virtuous nature may recoil
In an imperial charge.

[5] But, poor old man, thou prun'st a rotten tree,
That cannot so much as a blossom yield,
In lieu of all thy pains and husbandry.

[6] Being unprepared,
Our will became the servant of defect;
Which else should free have wrought.

(a) In what connexion does each of the above passages occur?
(b) Give the sense of each of them in simple prose.
(c) Notice every word which is used in an obsolete or unusual sense, and every peculiar construction.

2. [1] You know that I held Epicurus strong,
And his opinion: now I change my mind,
And partly credit things that do presage.

[2] ——witchcraft celebrates
Pale Hecate's offerings; and withered murther,
Alarum'd by his sentinel, the wolf,
Whose howl's his watch, thus with his stealthy pace,
With Tarquin's ravishing strides towards his design
Moves like a ghost.

(a) In what connexions do the above passages occur?
(b) Explain the allusions.
(c) Notice the peculiar constructions and uses of words.

3. Explain these expressions:—

[1] You'll be whipped for taxation.

[2] You ought not walk.

[3] You are the first that rears your hand.

[4] As lief not be.

[5] It irks me.

[6] Out of suits.

II.

1. Into what classes are the plays of Shakspere divided? To which class does each of the three plays belong?
2. Give some account of the sources from whence the plot of each of these plays was taken. Notice the principal deviations from the original narratives which Shakspere has made in Julius Cæsar and Macbeth.
3. Sketch the third act of Julius Cæsar. Compare the characters of Casca and Cassius.
4. Describe the character of Banquo.
5. Give some account of the early editions of Shakspere's plays.

Milton.

Paradise Lost; Books I. to VI.

I.

1. Thus they their doubtful consultations dark
Ended, rejoicing in their matchless chief:
As when from mountain tops the dusky clouds
Ascending, while the north wind sleeps, o'erspread
Heaven's cheerful face, the lowring element
Scowls o'er the darkened landskip snow, or shower;
If chance the radiant sun with farewell sweet
Extend his evening beam, the fields revive,
The birds their notes renew, and bleating herds
Attest their joy, that hill and valley rings.

(a) Express the sense of the above passage in simple prose.
(b) Explain all peculiar constructions and words employed in unusual senses.

2. [1] Blind Thamyris and blind Mœonides,
And Tiresias and Phineus, prophets old.

[2] From hence no cloud, or, to obstruct his sight,
Star interposed, however small, he sees,
Not unconform to other shining globes,
Earth and the garden of God, with cedars crowned
Above all hills: as when by night the glass
Of Galileo, less assured, observes
Imagined lands and regions in the moon:
Or pilot, from among the Cyclades
Delos or Samos first appearing, kens
A cloudy spot.

[3] Eden stretched her line
From Auran eastward to the royal towers
Of great Seleucia, built by Grecian kings—

[4] As when to them who sail
Beyond the Cape of Hope, and now are passed
Mozambic, off at sea north-east winds blow
Sabæan odours from the spicy shore
Of Araby the blest.

(a) State the connexion in which each of these passages occurs.
(b) Explain the allusions.
(c) Explain every obscurity arising from peculiar construction, peculiar arrangement, and words employed in unusual senses.

3. Give the meaning of the following expressions:—
Ethereal quintessence.
When Zephyrus on Flora breathes.
Speed succinct.
A boggy Syrtis.
Aurora's fan.
Maia's son.
Anarch—Tartarus—Arreed—Ambrosia.

4. What is to be noticed in the grammar of these passages?

[1] But cloud instead and ever during dark
Surrounds me.

[2] Ten thousand fathom deep.

[3] Than whom none higher sat.

[4] Before the heavens thou wert.

[5] Grinned horrible a ghastly smile.

[6] If thou beest he.

II.

1. To what portions of the Old and New Testaments was Milton most indebted for the outline of Paradise Lost?
2. What references are there in the first six books to the great controversies of Milton's day?
3. Quote some of the passages in which there is allusion made to the poet's personal history.
4. Sketch Milton's early life up to his first marriage. Give a list of his most important prose works.

Addison.

The Spectator, Vol. VIII.

I.

1. "To return, therefore, to my first thought, I could not but look upon myself with secret horror as a being that was not worth the smallest regard of one who had so great a work under his care and superintendency."

In what connexion does this passage occur? What are the main lines of thought by which the Spectator and one of his contributors in a later paper, correct the suggestion?

2. "I like the story of the honest Dutchman, who, upon breaking his leg by a fall from the mainmast, told the standers-by it was a great mercy it was not his neck."

What use does the Spectator make of this story?

3. Briefly sketch the story of Fadlallah. To illustrate what truth is it introduced?

4. What is the meaning of the story of Hilpa and Shalum?

5. "It must be owned that fear is a very powerful passion, since it is esteemed one of the greatest of virtues to subdue it."

How does the Spectator carry on this argument?

6. "A grotto so complete, with such design,
What hands, Calypso, could have formed but thine
Each checkered pebble, and each shining shell,
So well proportioned, and disposed so well,
Surprising lustre from thy thought receive,
Assuming beauties more than nature gave.
To her their various shapes and glossy hue,
Their curious symmetry they owe to you.
Not famed Amphion's lute, whose powerful call
Made willing stones dance to the Theban wall,
In more harmonious ranks could make them fall."

(a) In what connexion does this passage occur?
(b) Give the sense of it in plain prose.
(c) Explain the allusions and peculiar expressions.

II.

1. State the circumstances which occasioned the composition of the eighth volume of the Spectator. Name the principal contributors.

2. What are the characteristic qualities of Addison as an essayist?

3. Sketch the life of Addison. Give the titles of his chief works in prose and poetry.

Angus.

Handbook of the English Tongue. Chapters I. to VI.

1. From what languages does the English derive its chief elements? In what proportion does each of these languages contribute to our stock of words?

2. State the most important rules for detecting Anglo-Saxon words based on their meanings.

3. How are the English words derived from Latin classified historically? Give examples of each class.

4. What are the principal dialects of the old French language? Give some account of the one of them with which the study of English is most concerned.

5. How are the English words of Keltic origin classified? Give examples of each class.

6. "Etymology is not always a safe guide to the meaning of words." Explain this remark, and illustrate it by examples.

7. Into what periods is the history of the English language usually divided? State some of the characteristic peculiarities of the earlier periods. Name a few authors belonging to each.

8. Classify the Gothic languages.

9. Give the origins of the following words:—Avalanche, Meagre, Lieutenant, Friar, Esquire, Balance, Raisin, Toilette, Usher, Soldier, Tissue, Poison.

10. From what languages are the following words taken? Admiral, Zero, Gong, Amen, Basket, Sofa, Algebra, Scimetar, Mop, Scarlet, Bandit, Lilac, Gravel, Potato, Yacht.

Tennyson.

Idylls of the King.—In Memoriam.

I.

1. [1] O purblind race of miserable men,
How many among us at this very hour
Do forge a life-long trouble for ourselves,
By taking true for false, or false for true;
Here, through the feeble twilight of this world
Groping, how many, until we pass and reach
That other, where we see as we are seen!

[2] But when the Prince had brought his errant eyes
Home from the rock, sideways he let them glance
At Enid, where she droopt: his own false doom,
That shadow of mistrust should never cross
Betwixt them, came upon him, and he sighed;
Then with another humourous ruth remarked
The lusty mowers labouring dinnerless,
And watched the sun blaze on the turning scythe
And after nodded sleepily in the heat.

(a) Give the sense of each of the above passages in simple prose.
(b) Notice every word used in an unusual sense.

2. What is the substance of Enid's song? How is it connected with her character and history?

3. Sketch the story of Elaine.

4. Trace the gradual development of Guinevere's guilt in the notices of her which occur in the first three of the Idylls.

5. Compare the character of King Arthur with that of Geraint.

6. With what purpose is reference made to the raising of Lazarus in In Memoriam?

7. [1] 'Tis better to have loved and lost
Than never to have loved at all.

[2] But for the unquiet heart and brain,
A use in measured language lies;
The sad mechanic exercise,
Like dull narcotics numbing pain.

And what delights can equal those
That stir the spirit's inner deeps,
When one that loves but knows not, reaps
A truth from one that loves and knows?

[4] O last regret, regret can die!
No—mixt with all this mystic frame,
Her deep relations are the same,
But with long use her tears are dry.

(a) In what connexions do these passages occur?
(b) Put the thoughts expressed in them into simple prose.

II.

1. What is the meaning of the word Idyll?

2. Give an account of the sources from which the stories of the Idylls are taken.

3. Which do you prefer of the four Idylls? State the grounds of your preference.

4. What series of poems is considered to have a resemblance to In Memoriam, regarded as an expression of human feeling? What are the chief points of likeness and unlikeness which strike you in making the comparison? Do you think that Tennyson's work was suggested by the older one?

5. What facts of personal history can be gathered from In Memoriam which throw light on the occasion of its composition?

6. What are the principal faults which have been found with In Memoriam? In which of these alleged faults does it stand in remarkable contrast to the Idylls? Do you consider that the faults are justly urged? If not, on what grounds do you defend the work.

Pope.

Essay on Man—Essay on Criticism—The Rape of the Lock.

I.

1. [1] Who noble ends by noble means obtains,
Or, failing, smiles in exile or in chains,
Like good Aurelius let him reign, or bleed
Like Socrates, that man is great indeed.
[2] Our school divines this zealous isle o'er spread;
Who knew most sentences, was deepest read:
Faith, gospel, all, seemed made to be disputed,
And none had sense enough to be confuted:
Scotists and Thomists, now in peace remain,
Amidst their kindred cobwebs in Duck-lane.
[3] Close by those meads, for ever crown'd with flowers,
Where Thames with pride surveys his rising towers,
There stands a structure of majestic frame,
Which from the neighbouring Hampton takes its name.
[4] The mighty Stagyrite first left the shore,
Spread all his sails, and durst the deeps explore;
He steer'd securely, and discovered far,
Led by the light of the Mæonian star.
Poets, a race long unconfined and free,
Still fond and proud of savage liberty,
Received his laws; and stood convinced 'twas fit
Who conquered nature should preside o'er wit.

(a) In what connexion does each of the above passages occur?

(b) Express the sense of the second and fourth passages in simple prose.

(c) Explain the allusions.

(d) Notice the peculiarities in the grammar and in the use of particular words.

2. A little learning is a dangerous thing!
Drink deep or taste not the Pierian spring;
There shallow draughts intoxicate the brain,
And drinking largely sobers us again.

(a) What is meant by the Pierian spring?

(b) Do you entirely agree with the poet? Give the reasons of your answer.

II.

1. Give a sketch of the argument of the Essay on Criticism.

2. What do you consider to be the unsound parts of the reasoning in the Essay on Man?

3. What was the incident which occasioned the composition of the Rape of the Lock? Give some account of the source from whence Pope took the machinery of the poem.

4. Sketch the life of Pope. Name some of his most famous contemporaries. Give a list of his principal works.

LOGIC AND MENTAL SCIENCE.

THREE HOURS ALLOWED.

All candidates should attempt six Logic questions, answering a part at least of question No. 13, and three questions in each of the other books which they have studied. They may, however, answer as many questions as they can.

1. Logic is concerned about the laws of thought, and not about the truth of things. Explain shortly that statement.

2. How are concepts or general notions formed?

3. What is meant by the extension and what by the comprehension of a concept? Give a few examples. State the law which regulates the mutual relations of extension and comprehension.

4. Give its logical name to each of the parts of this proposition: "To rise early is beneficial."

5. Express the following propositions, using the logical copula: "Man wants but little here below." "Poor people have few friends."

6. What is meant by the quantity and the quality of a proposition? And what are the signs of quantity and quality?

7. What is the rule of distribution in the case of universal affirmatives? Give an example, and also an instance in which the rule is violated.

8. Of what predicables is the species composed? What is Thomson's opinion in regard to the composition of the species?

9. Define Astronomy—a University—a School, naming the two parts of the definition.

10. What is the distinction between immediate and mediate inference?

11. State and illustrate the opposition between A and O.

12. Give a table of the syllogistic figures, taking M for the middle term, S for the minor term, and P for the major term.

13. State the mood and figure, and pronounce on the validity of each of the following syllogisms, pointing out the kind of fallacy which any of them may involve.

(*a*) All wise men speak little.
I am a wise man,
Therefore I speak little.
(*b*) All wise men speak little.
I speak little,
Therefore I am a wise man.
(*c*) The good are loved.
Aspasia was loved,
Therefore Aspasia was good.
(*d*) All vices excite indignation.
Emulation does not excite indignation,
Therefore emulation is not a vice.
(*e*) All humane men are lovers of liberty.
No slave-dealers are humane men,
Therefore, no slave-dealers are lovers of liberty.

14. Construct a syllogism in A A A in the second figure, and show what fallacy it involves.

15. Reduce to the first figure the following syllogism:—
The passions are common to brutes.
The virtues are not common to brutes.
Therefore, the virtues are not passions.

Or construct a syllogism of your own in the third figure, and reduce it to the first.

Paley's Moral Philosophy.

1. State shortly Paley's arguments in disproof of a moral sense.

2. What, according to Paley, are the constituents of happiness?

3. What is Paley's definition of virtue?

4. Why, according to Paley, am I obliged to keep my word; and what is the difference between an act of prudence and an act of duty? Criticise his doctrine.

5. What is meant by the general, as distinguished from the particular, consequences of an action?

6. Give two or three instances showing that the general consequences of an action may be ruinous to society, while its particular consequences are insignificant.

7. As an objection to the doctrine of utility, it is said that before acting we must calculate the consequences of our actions, but that it is generally impossible to do this. Show how this objection is obviated by means of "general rules."

8. Give a short account of Paley's chapter "On wills."

Bishop Butler's Sermons.

1. Against whose doctrines in particular was the moral system of Butler directed?

2. What is Butler's general division of the principles of human nature?

3. What does he mean by "our nature" when he says that virtue consists in following our nature?

4. How does he establish the supremacy of conscience?

5. Explain Butler's doctrine of our appetites and desires, and contrast it with the doctrine which it was designed to refute?

6. How does self-love defeat its own end when it becomes a contracted affection? And how is self-love shown by Butler to be quite consistent with our love of our neighbour? In which sermon are these questions treated of?

7. Give a very short and general outline of his moral system.

Stewart's Philosophy of the Human Mind.

1. What is Stewart's doctrine of the will "in the case of operations which are become habitual in consequence of long practice?"

2. Distinguish between memory and conception.

3. In what respect do Reid and Stewart differ in their doctrines regarding the imagination.

4. Illustrate "casual associations" as a source of popular superstitions and prejudices. How are such prejudices best cured?

5. Into what principles does Stewart analyse the imagination.

6. Show how sensibility depends on the power of imagination.

7. "Experience diminishes the influence of passive impressions on the mind, but strengthens our active principles." Explain and illustrate this statement.

Bacon's Novum Organon.

1. Describe the different idols which beset the human mind.

2. Can you state when and where any of the Greek philosophers mentioned by Bacon lived?

3. What does Bacon mean by "Induction by simple enumeration," and what is his opinion of it?

4. How, according to Bacon, have men usually gone to work "in the investigation and discovery of any matter?"

5. How are the empiric, the dogmatist, and the true scientific labourer charcterised by Bacon?

6. How was natural philosophy corrupted by Aristotle, by Plato, and by the new Platonists?

7. What is "the real and legitimate goal of the sciences," and how has it been missed?

LATIN AND ROMAN HISTORY.

THREE HOURS ALLOWED.

Section I.

Translate—

Magnanime Aenea, non, si mihi Jupiter auctor
Spondeat, hoc sperem Italiam contingere cœlo.
Mutati transversa fremunt et vespere ab atro
Consurgunt venti, atque in nubem cogitur aër;
Nec nos obniti contra nec tendere tantum
Sufficimus. Superat quoniam Fortuna, sequamur,
Quoque vocat, vertamus iter. Nec litora longe
Fida reor fraterna Erycis portusque Sicanos,
Si modo rite memor servata remetior astra.
Tum pius Aeneas; Equidem sic poscere ventos
Jamdudum et frustra cerno te tendere contra.

1. Parse fully the words, *spondeat, cœlo, transversa, cogitur, sequamur, litora, servata, cerno.*

2. What is the general rule for the construction of *si?* Distinguish between *si dat, si dedit, si det, si daret, si dederit, si dedisset.*

3. Give the perfect tenses indicative of the verbs *contingere, fremunt, consurgunt, obniti, sufficimus, remetior, poscere.*

Section II.

Translate—

Excipiunt plausu pavidos, gaudentque tuentes
Dardanidæ, veterumque agnoscunt ora parentum.
Postquam omnem laeti consessum oculosque suorum
Lustravere in equis; signum clamore paratis
Epytides longe dedit, insonuitque flagello.
Olli discurrere pares atque agmina terni
Deductis solvere choris, rursusque vocati
Convertere vias infestaque tela tulere.
Inde alios ineunt cursus aliosque recursus
Adversis spatiis, alternosque orbibus orbes
Impediunt, pugnaeque cient simulacra sub armis;
Et nunc terga fuga nudant, nunc spicula vertunt
Infensi, facta pariter nunc pace feruntur.

1. Parse fully the words, *clamore, paratis, discurrere, ineunt, orbibus, fugâ, pace, feruntur.*

2. Give the perfect tenses indicative and the supines of the verbs *impediunt, cient, diductis, vertunt, factâ.*

3. What moods and tenses may be put after *post quam,* and with what meaning in each case?

Section III.

Translate—

Cum ipsa per sese res anceps esset, prout cujusque ingenium erat atrocius mitiusve suadentibus, tum incertiora omnia unus ex Privernatibus legatis fecit, magis condicionis, in qua natus esset, quam praesentis necessitatis memor, qui interrogatus a quodam tristioris sententiae auctore, quam poenam meritos Privernates censeret, "eam" inquit "quam merentur qui se libertate dignos censent;" cujus cum feroci responso infestiores factos videret consul eos, qui ante Privernatium causam impugnabant, ut ipse benigna interrogatione mitius responsum eliceret "quid, si poenam" inquit, "remittimus vobis, qualem nos pacem vobiscum habituros speremus?" "si bonam dederitis," inquit "et fidam et perpetuam: si malam haud diuturnam."—*Livy*. viii. 21.

1. Parse fully the words, *suadentibus, conditionis, interrogatus, censeret, libertate, responso, diceret, habituros.*

2. Give the perfect tenses indicative of the words, *merentur, censent, viderat, remittimus, dederitis.*

3. What is meant by *oratio obliqua?* Why is *censeret* in the subjunctive mood? Put the last answer of the *Privernat* in the above passage into the oblique form.

Section IV.

Translate—

Legati circumstantes sellam orabant, ut rem in posterum diem differret, et irae suae spatium et consilio tempus daret. Satis castigatam adolescentiam Fabii esse, satis deformatam victoriam: ne ad extremum finem supplicii tenderet, neu unico juveni, neu patri ejus clarissimo viro, neu Fabiae genti eam injungeret ignominiam. cum parum precibus, parum causa proficerent, intueri sævientem contionem jubebant. ita irritatis militum animis subdere ignem ac materiam seditioni non esse aetatis non prudentiae ejus. neminem id Q. Fabio poenam deprecanti suam vitio versurum, sed dictatori, si occaecatus ira infestam multitudinem in se pravo certamine movisset. postremo ne id se gratiae dare Q. Fabii crederet, se jus jurandum dare paratos esse non videri e re publica in Q. Fabium eo tempore animadverti.—*Livy*. viii. 32.

1. Parse fully the words, *circumstantes, diem, iræ, injungeret, animis, ætatis, vitio, dictatori.*

2. Give the perfect tenses indicative and the supines of the verbs, *differret, tenderet, proficerent, subdere, deprecanti, versurum, movisset, crederet.*

3. Put the words, "Postremo ne id se gratiæ dare Q. Fabii crederet, se jus jurandum dare paratos esse non videri e re publica in Q. Fabium eo tempore animadverti," into the direct form.

Section V.

1. Give an account of the Licinian Rogations.

2. What were the original powers of the Tribunate? Were any modifications made in the office as time went on?

3. In what relation did Latium stand to Rome just after the Gauls had quitted Rome, during the second Punic War, and in the days of the Gracchi?

4. What successive changes were made in the Roman law concerning debt?

5. What were the powers of a Dictator? What were the most important occasions of the appointment of such an officer?

6. Give an account of the first Samnite war.

Section VI.

1. Give an account of the Catilinarian conspiracy. What disputed point of Roman law was the Senate called upon to decide in dealing with the captured conspirators?

2. Sketch the life of Pompey.

3. Give an account of the successive Agrarian laws, which were either passed or proposed.

4. Distinguish between the Comitia Curiata, Comitia Centuriata, and Comitia Tributa.

5. By what steps did the Romans become a maritime power?

6. Give an account of the Roman Colonies, and define the rights which the colonists had.

FRENCH.

THREE HOURS ALLOWED.

Part I.

Candidates for a Third-class Certificate are to translate the following extract into English, and to answer the grammatical questions thereto annexed (in the order in which they are placed). The first part is all that is required of them.

Nous manquons essentiellement de la vertu civique avec laquelle les hommes des anciens jours rendaient service à la patrie au dernier rang. La maladie de notre temps est la Supériorité : il y a plus de saints que de niches. Voici pourquoi : avec la monarchie s'en est allé *l'honneur;* avec la Religion de nos pères, *la vertu chrétienne;* avec nos infructueux essais de gouvernement, *le patriotisme;* du moins, ces principes-là n'existent plus que partiellement au lieu d'animer les masses ; car les idées ne périssent jamais. Maintenant nous n'avons plus pour étayer l'ordre social d'autre soutien que *l'égoïsme.* Les individus croient en eux; l'avenir, c'est l'homme social; nous ne voyons rien au-delà. Le grand homme qui nous sauvera du naufrage vers lequel nous courons, se servira sans doute de ce ressort pour nous refaire nation; mais en attendant cette régénération, nous sommes dans le siècle des intérêts matériels et du positif. Ce dernier mot est celui de tout le monde. Nous sommes tous chiffrés, non d'après ce que nous valons, mais d'après ce que nous pesons. Aussi l'homme d'énergie obtient-il à peine un regard, s'il est en veste. Ce sentiment a passé dans le gouvernement. Le ministre envoie une médaille d'argent au marin qui sauve au péril de ses jours une douzaine d'hommes, et donne la croix d'honneur au député qui lui vend sa voix.—Balzac.

1. Parse the first two sentences of the above extract (down to "niches").

2. Give in distinct lines the five primitive tenses of each of the following verbs:—*S'en est allé, croient, voyons, courons, se servira, valons, obtient.*

3. Put the article and a suitable epithet before each of the following nouns, so as to show its gender:—*Faîte, parterre, rhume, brume, lierre, adage, parachûte, parafe, épices, cortége, trapèze, enclume, légume, cloison, laboratoire, poix, chaux, platine.*

4. Give the substantive which corresponds to each of these adjectives:—*Civique, ancien, saint, social, grand, matériel;* and also the adjective which corresponds to each of these nouns:—*Vertu, homme, supériorité, monarchie, religion, patriotisme, idée, égoïsme, intérêt, péril.*

5. Give the nouns and adjectives that correspond to *essentiellement* and *partiellement,* and state how a French adverb is formed.

6. Explain why, in the last sentence but two of the extract, the nominative case comes after the verb, viz., "obtient-il," as though the question were interrogative, which is not the case. Can you give other instances of a similar construction?

7. State the difference there is between *du moins* (7th line) and *au moins.*

8. What is the meaning and use of the particles *ci* and *là* in: "cet homme-ci," "ces principes-là?"

9. Explain the particle *ne* in every one of the following different sentences:—

"On se voit d'un autre œil qu'on *ne* voit son prochain."
—La Fontaine.

"Car que faire en un gîte, à moins que l'on *ne* songe?"
—La Fontaine.

"Gardez qu'une voyelle à courir trop hâtée,
Ne soit d'une voyelle en son chemin heurtée."
Boileau.

"Je tremble qu'Athalie * * * * *
*N'*achève enfin sur vous ses vengeances funestes,
Et d'un respect forcé *ne* dépouille les restes."
Racine.

"Depuis l'invention de la poudre, les batailles sont moins sanglantes qu'elles *ne* l'étaient."—Montesquieu.

10. Show with examples when *will, would, should, may,* and *might,* must be considered as mere auxiliaries of the verb which they precede, and when, on the contrary, they are separate verbs to be rendered separately by some tense of *vouloir, devoir,* or *pouvoir,* in French.

11. Give all the constructions and meanings of "que" in French.

12. When is it desirable to use *lequel, laquelle, lesquels,* &c.,, *duquel,* instead of *qui, que, dont?*

13. In the answers of a dialogue the French language is less elliptical than the English. Illustrate this rule by a few examples, such as—

Is it a letter you are reading?—Yes, *it is.*
Is that quotation from Bayle?—Yes, *it is.*
Do you understand French?—Yes, *I do.*
Are you going away?—No, *I am not.*

14. Conjugate the verbs *venir* and *s'émouvoir,* giving the first person singular and plural of all the tenses, including the compound ones, with the English.

Part II.

Candidates for a Second-class Certificate are to answer the next four grammatical questions, and to translate the English extract and the idiomatic expressions which follow:—

I.—Grammar.

1. Show to what extent the French syntax differs from the English in reference to *personal pronouns.* Illustrate your answer with examples.

2. Will you keep the pronoun in the same *case* in rendering these sentences in French:—Let *him* read—let *him* read his book; make *him* write—make *him* write his letter.

3. Correct the mistakes here:—*Quoique* vous fassiez, *quelques* soient vos talents, *quelques* honorables que vous soyez, vous aurez toujours des détracteurs.

4. How do you account for the difference in the spelling of these past participles:—

Je les ai *envoyé* chercher par la police.
Je les ai *envoyés* chercher la police.

II.—Translation.

The service, therefore, rendered by Voltaire in purging history of these foolish conceits, is, not that he was the first by whom they were attacked, but that he was the first to attack them with success; and this because he was also the first who mingled ridicule with argument, thus not only assailing the system, but also weakening the authority of those by whom the system was supported. His irony, his wit, his pungent and telling sarcasms, produced more effect than the gravest arguments could have done; and there can be no doubt that he was fully justified in using those great resources with which nature had endowed him, since by their aid he advanced the interest of truth, and relieved men from some of their inveterate prejudices.

It is not, however, to be supposed that ridicule was the only means employed by Voltaire in effecting this important object. So far from that, I can say with confidence, after a careful comparison of both writers, that the most decisive arguments advanced by Niebuhr against the early history of Rome had all been anticipated by Voltaire, in whose works they may be found by whoever will take the trouble of reading what this great man has written, instead of ignorantly railing against him.—H. T. Buckle.

III.—Idioms.

1. Advienne que pourra, je m'en lave les mains.
2. Vous n'y êtes point, je vous le donne en cent.
3. Il a voulu m'en donner à garder.
4. Il n'y va pas de main morte.
5. Vous avez l'air de revenir de Pontoise.
6. A bon chat bon rat.
7. On lui a tiré une plume de l'aile.
8. Il sait faire patte de velours.

Part III.

Candidates aiming at a First-class Certificate are expected to translate the above English extract and idiomatic expressions, and to answer, *in French*, the following questions:—

Literature.

1. What are the principal works of Molière, Pascal, Boileau, and Racine? Give an epitome of one of Molière's comedies or one of Racine's tragedies.

2. Sketch the life of either Madame de Sévigné or Bossuet.

3. Explain the healthy influence of Boileau and the other great writers, his contemporaries, on their age and country.

History.

State what you know of the administration of Colbert, and name some of the principal measures for which France was indebted to him.

GERMAN.

THREE HOURS ALLOWED.

Each candidate is expected to translate one of the following passages; to answer some of the grammatical questions, and turn into German several of the sentences and pieces given for this purpose. Candidates for a first class must translate one piece of Section I., (e) and (f) of Section II., and 23, 24, and 25 of Section III., and write the Essay.

Section I.

1. Ihrem Beispiel folgten auch die übrigen adeligen Herren, Grafen und Ritter. Jeder wollte so unabhängig wie möglich sein. Einen Herrn und Richter über sich zu haben konnte er schwer ertragen; und wenn er sich beschädigt oder beleidigt glaubte, so schaffte er sich lieber mit dem Schwerte Genugthuung, als dass er eine Klage bei dem ordentlichen Richter, oder dem Könige, als höchstem Richter, hätte erheben und den Urtheilspruch abwarten sollen. Diese Neigung mit der Faust sich Recht zu verschaffen, fängt seit Ludwig des Frommen Zeit, der mit seinen eigenen Söhnen das Beispiel gegeben hatte, schon an, und hat sechs Jahrhunderte hindurch in unserm Vaterlande mehr oder weniger geherrscht. Man nennt dieses die Zeit des Faustrechts, wovon weiter unten ausführlicher die Rede sein wird. Doch war es nicht immer gleich arg. Wenn ein kräftiger König regierte, der sich Ansehen zu verschaffen wusste, so ging es doch im Ganzen viel ruhiger und friedlicher zu.

2. Kein Wunder, dass ein so unnatürliches Gericht, das selbst dem duldsameren Geist der Spanier unerträglich gewesen war, einen Freistaat empörte. Aber den Schrecken, den es einflösste, vermehrte die Spanische Kriegsmacht, die auch nach wiederhergestelltem Frieden beibehalten wurde, und, der Reichsconstitution zuwider, die Gränzstädte anfüllte. Karl dem Fünften hatte man diese Einführung fremder Armeen vergeben, weil man ihre Nothwendigkeit einsah, und mehr auf seine guten Gesinnungen baute. Jetzt erblickte man in diesen Truppen nur die fürchterliche Zurüstung der Unterdrückung und die Werkzeuge einer verhassten Hierarchie. Eine ansehnliche Reiterei, von Eingeborenen errichtet, war zum Schutze des Landes hinreichend und machte diese Ausländer entbehrlich. Die Zügellosigkeit und Raubsucht dieser Spanier, die noch grosse Rückstände zu fordern hatten, und sich auf Unkosten des Bürgers bezahlt machten, vollendeten die Erbitterung des Volks and brachten den gemeinen Mann zur Verzweiflung.

3. Schnell fertig ist die Jugend mit dem Wort,
Das schwer sich handhabt, wie des Messers Schneide
Aus ihrem heissen Kopfe nimmt sie keck
Der Dinge Maass, die nur sich selber richten.
Gleich heisst ihr alles schändlich oder würdig,
Bös oder gut—und was die Einbildung
Fantastisch schleppt in diese dunkeln Namen,
Das bürdet sie den Sachen auf und Wesen.
Eng ist die Welt, das Gehirn *weit*.
Leicht bei einander wohnen die Gedanken;
Doch hart im Raume stossen sich die Sachen;
Wo eines Platz nimmt, muss das Andre rücken—
Wer nicht vertrieben sein will, muss vertreiben;
Da herrscht der Streit, und nur die Stärke siegt.
Ja, wer durchs Leben gehet ohne Wunsch,
Sich jeden Zweck versagen kann, der wohnt
Im leichten Feuer mit dem Salamander,
Und hält sich rein im reinen Element.

4. Ausführlich und umständlich, wie es der König liebt, Ich erzähle, wie zuerst zu St. Omer die bilderstürmerische Wuth sich zeigt. Wie eine rasende Menge mit Stäben, Beilen, Hämmern, Leitern und Stricken versehen, von wenigen Bewaffneten begleitet, erst Kapellen, Kirchen und Klöster anfallen, die Andächtigen verjagen, die verschlossenen Pforten aufbrechen, alles umkehren, die Altäre niederreissen, die Statuen der Heiligen zerschlagen, alle Gemälde, verderben, alles, was sie nur Geweihtes, Geheiligtes antreffen, zerschmettern, zerreisssen, zertreten. Wie sich der Haufe unterwegs vermehrt, die Einwohner von Ypern ihnen die Thore eröffnen. Wie sie den Dom mit unglaublicher Schnelle verwüsten, die Bibliothek des Bischofs verbrennen. Wie eine grosse Menge Volks, von gleichem Unsinn ergriffen, sich über Menin, Comines, Verwich, Lille verbreitet, nirgend Widerstand findet, und wie fast durch ganz Flandern in einem Augenblick die ungeheure Verschwörung sich erklärt und ausgeführt ist.

Section II.—Grammar and Idioms.

(a) When do you use mein, dein, &c., in the Nom. Masc. and Neuter, and when meiner, meines, deiner, deines, &c.?

(b) When must the personal pronouns he, she, it, they, be translated by derjenige, &c.?

(c) What is the difference between the relative pronouns wer and welcher?

(d) When must the verb be placed at the end of a sentence?

(e) How do you treat a relative clause of which you omit the relative pronoun and the auxiliary verb, such as "the people, assembled in great numbers, hailed the Princess with enthusiasm?"

(f) Er macht sich nichts aus ihm (daraus).
Nehmen Sie sich in acht.
Es liegt mir nichts daran.
Es lag nicht an mir.
Ich will es darauf ankommen lassen.
Jetzt war guter Rath theuer.
Die er für seine wärmsten Freunde hielt, brachten ihn um seinen guten Ruf.
Solches Wetter bringt mich um.
Auf welche Weise kam er um?
Nun galt es die Augen offen halten.
Was gilt's, er lässt sich nichts merken?
Wenn es auf mich ankäme, so sollte ihm die Sache nicht schwer fallen.
Er behauptet, es gälte nichts weniger als das Leben.
Ich werde mich schon zurecht finden, wenn ich nur einmal weiss, wo ich dran bin.

Section III.

Translate into German ten of the following passages either in English or German character, but very legible.

1. It has left off raining.
2. The clouds are dispersing.
3. The sky is clear.
4. The weather is getting fine.
5. Let us take a walk.
6. Where shall we go to?
7. Let us go into the park.
8. The gravel there soon dries.
9. How did you spend last evening?
10. I was in a very pleasant company, where they played and sang.
11. Did they play music or at cards?
12. I am no card-player, and never go to a place where I know card-playing is going on, and never stay when they unexpectedly begin to play.
13. No, several ladies played on the piano, some played solos, others duets; and they all played well, and good pieces.
14. You must get your coat mended.
15. He has had his house painted from top to bottom.
16. Make the boy learn his lesson.
17. They caused him to be sent out of the country.
18. I have not been able to answer him as I could have wished.
19. Would you have engaged in such an undertaking if it had been in your power?
20. I have heard it said by several people that he was helped in this essay by more than one person.
21. His wounds were cured through the skill of Mr. N— in an incredibly short time.
22. He was met in his journey by a friend whom he believed to be then travelling in South America.
23. Not having received the information I expected, I refused to enter into any engagement.
24. He relies on your informing him as soon as you have made up your mind to enter upon the proposed emigration.
25. Life has been compared to a river. If ours is not such, it is because its springs are not on the mountain, but in marshes and the lowlands. The peace promised to the good man shall not be like a shower falling with temporary abundance, but like the river which flows by the cottage door, always full and always singing. The man hears it when he rises in the morning; he hears it in quiet noon; he hears it when the sun goes down; and, if he wakes in the night, its sound is in his ear. It was there when he was a child; it was there when he grew up to manhood; it is there now that he is old and decrepit; and it will murmur by his grave upon its banks; nay, it will flow and sing for his children after him.

Write, in German, a short and concise essay: On the Utility of the Study of Languages, as a Discipline to the Mind.

FREE-HAND DRAWING.

THREE HOURS ALLOWED.

Make a drawing in outline of the cask and wheelbarrow which is in the room, and indicate the strong points of the shadows as they appear to you.

Draw, from recollection, a branch of a vine with leaves and fruit.

Make an enlarged outline, not less than eight inches in length, from the Queen's head on the new bronze coinage.

Make an original design, either for ornament or in figure, the subject given being, a parasite.

Candidates are not expected to attempt all the subjects given in this paper.

Directions for the Local Boards.

Put a thirty gallon cask on a wheelbarrow, and place it in the room before the candidates in free-hand drawing.

Supply each of the candidates with a penny-piece of the new bronze coinage.

GEOMETRICAL DRAWING.

THREE HOURS ALLOWED.

The constructions must be accurate, and show clearly, by plain and dotted lines, with appropriate letters of reference, the principles on which they are based. They may be put in ink, or left in pencil, at the discretion of the candidate, provided they are distinct.

No deviation from the conditions of the questions can be admitted; and since no candidate must answer more than two questions from any one section, he is advised not to attempt more than the time will admit of his completing, since little or no credit will be given for incompleted or inaccurate answers.

I.

1. Draw a circle of 1·5 inches radius; inscribe and circumscribe it with squares, having their sides parallel.
2. Draw a square of three inches side, divide it into 64 equal squares, put a light tint of Indian ink on thirty-two of them so as to form a chess board.
3. Draw sixteen equal circles of ·75 inches in diameter, their centres being in the intersections of four parallel lines, 1·5 inches apart, with four others at the same distance, and at right angles to them.
4. Draw a circle of two inches radius; divide its circumference into six equal arcs; describe an arc of a circle of two inches radius from each point of division, stopping these arcs at the circumference of the first, and each arc passing through its centre.

N.B.—These questions are intended to test the candidate's neatness and accuracy.

II.

1. Draw in one figure two squares of one and two inches *area*.
2. Draw a semi-circle of 1·5 inches radius; determine a point in its circumference such that the chords drawn from it to the ends of the diameter shall be as $1 : \sqrt{2}$.
3. Construct a rectangle of three inches area, and having its sides as 2 : 3.
4. Draw a regular pentagon of 1·5 inches side, and a square equal to it in area.

5. Construct a triangle having its sides as 2 : 3 : 4, but inscribed in a circle of 1·5 inches radius.

6. Draw a triangle, its sides being 2, 2·5, 3 inches; bisect this triangle:—

1. By a line parallel to one side.
2. By a line perpendicular to one side.

III.

1. Draw a circle of 1·5 inches radius: in it inscribe four equal circles, each touching two others.

2. Two circles of 2 and ·75 inches radii touch one another internally; draw a third circle of one inch radius to touch both, but not at the point of contact of the first two.

3. Draw an ellipse having its axes 3·5 and 2·5 inches, without using the foci.

4. Draw the curve line, every point of which is equidistant from a given straight line, and a point at one inch from that straight line.

IV.

1. The sides of a rectangle are three and two inches long; draw the *plan* of it when those sides are inclined to the paper 40° and 60°.

2. An equilateral triangle of two inches side has its three corners at 1, 2, and 2·5 inches above the paper. Draw its *plan*.

3. The plane of a square of two inches side is inclined at 50°, and the diagonal is inclined at 30°. Draw its *plan*.

4. Two diameters, containing an angle of 60°, of a circle of two inches radius, are inclined at equal angles of 35° to the plane of the paper. Draw the *plan* of the curve.

V.

A right pyramid, four inches high, has for its base a pentagon of 1·5 inches side. Draw a *plan* and *elevation* of the solid under the following conditions of position:—

1. When one *face* is horizontal.
2. When one *edge* is horizontal, and the plane of an adjacent face inclined to the paper at 26°.
3. When two faces are vertical.
4. When it is suspended freely from one corner of the base.
5. The solid is cut by a plane parallel to one face, and at ·3 inch from it. Draw the form of the section.
6. Show the *developed* surface of the frustum.

VI.

1. A right cone, four inches high, with a circular base of 1·5 inches radius, stands on the paper; it is touched by three equal spheres, each of which touches the other two. Show a plan of the whole.

2. Two equal triangular pyramids, all the faces of which are equilateral triangles of 2·5 inches side, are placed with two faces in contact, so that the edges of one are opposite the centre line of the faces of the other pyramid; all these faces being supposed produced, determine the mutual intersection of the two, and draw a plan and elevation of them.

3. The axes of two equal cylinders, 3·5 inches long and 3·5 inches in diameter, meet at right angles in their centres. Show the two solids penetrating each other in isometrical projection.

4. A square of two inches side is parallel to the plane of projection (the picture). Determine its distance from that plane when its perspective projection is a square of equal area, half its area, or double its area, the distance of the eye being five inches.

MUSIC.

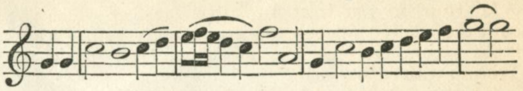
THREE HOURS ALLOWED.

I. Rudiments of Musical Grammar.

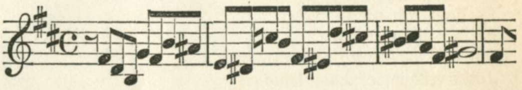
(The answers to Nos. 1 to 4 must be written on music paper.)

1. Give an example of every kind of time with which you are acquainted, and write over each example *what* kind (simple, common, or other) it is in.

2. Write the following passage in $\frac{2}{4}$ time.



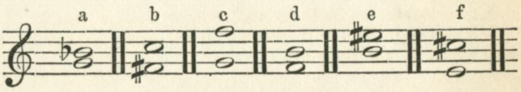
3. Transpose the following into *Do* (C) minor.



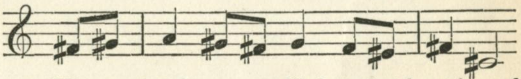
4. Write the signatures of *Fa* (F), *Sol* (G), and *La* ♭ (A ♭) *major;* and of *Re* (D), *Mi* (E), and *Fa* (F) *minor*.

5. Explain what is meant by the inversion of an interval, and state what change (of quality) each diatonic interval undergoes on inversion.

6. Name the intervals formed by the following, specifying the quality (major, perfect, or other) of each:—



7. In what scale, or key, is the following:—

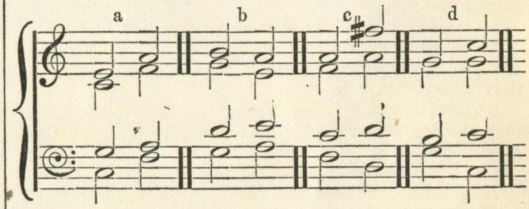


8. What modulations are we likely to find in a piece of music in the scale, or key, of *Re* (D)?

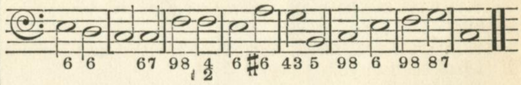
II. Harmony, Counterpoint, and Musical History.

(The answers to Nos. 1, 2, and 3, must be written on music paper.)

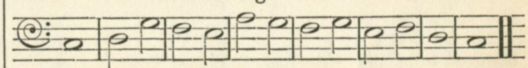
1. Correct the errors in the following with as little alteration of the parts as possible:—



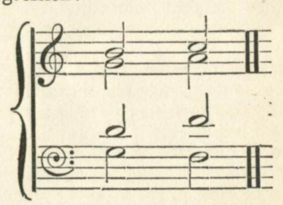
2. Add three parts to the following figured bass:—



3. Add a part, or parts, in any species of counterpoint, above or below the following:—



4. What is there exceptional, or objectionable, in the following progression:—



5. In what countries were the following composers born, and in what centuries did they flourish:—Arne, J. S. Bach, Croft, Orlando Gibbons, Haydn, Josquin des Près, Mozart, Palestrina, Purcell, Rossini, Tallis.